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101 Ways to Try to Grow Arabidopsis: What Photoperiod (Daylength) Worked Best in This Study?

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Purdue Methods:

What photoperiod (daylength) worked best in this study?

Short answer:

16 hours for flowering

Results:
It comes as no surprise that 'Columbia' plants grown under winter photoperiods (<12 hours) did not flower during the duration of this experiment, whereas all plants grown under 16-hour photoperiod flowered. We confirmed that growth was vigorous under both 16-hour and 24-hour photoperiods, and that flowering occurred 8-12 days earlier using 24-hour photoperiods. The 24-hour treatment was promising, but no data was taken comparing seed production.

Discussion:
Critical photoperiod to induce flowering has been reported as 8 hours by Corcos (4) and as 12 hours by Tocquin et al (12). Our studies were done with 'Columbia' wild types and will not apply to all *A. Thaliana*. There may be some occasional research use for large, vegetative plants such as we produced with short photoperiods, but the vast majority of our researchers need seed production.

We were intrigued by the use of 24-hour photoperiods used by some researchers at Purdue University and as reported by others (1, 2, 10). We investigated how growth would compare between 16-hour and 24-hour illumination, with an eye toward speeding up production for large-scale, high thru-put mutant screening projects. Conventional wisdom would suggest these the 24-hour illuminated plants may not produce as much seed, having had less time to accumulate carbohydrates by vegetative growth. We found only one report that suggested lower seed yield results from this treatment, and it involved "weak mutants" (7). Also, it was difficult for us to keep the plants irrigated because of the increased water use of continuous-lighted plants, and many plants died of water stress. Researchers who use this technique have to keep their plants sub-irrigated continuously, and one wonders if this may be the origin of the myth of this species needing constant sub-irrigation. Nutrition is another concern of plants under continuous light; often these plants look nutrient-starved, with the light duration being (or mutant genetics) assumed causal. Further study needs to be conducted using 24-hour light with increasing rates of fertilizer to see if these deficiencies can be overcome. Other treatments in our study suggest that 'Columbia' is more responsive to fertilization than often prescribed.

This document is based on materials originally posted to the Purdue University HLA Department Plant Growth Facility web site: http://www.hort.purdue.edu/hort/facilities/greenhouse/101exp.shtml

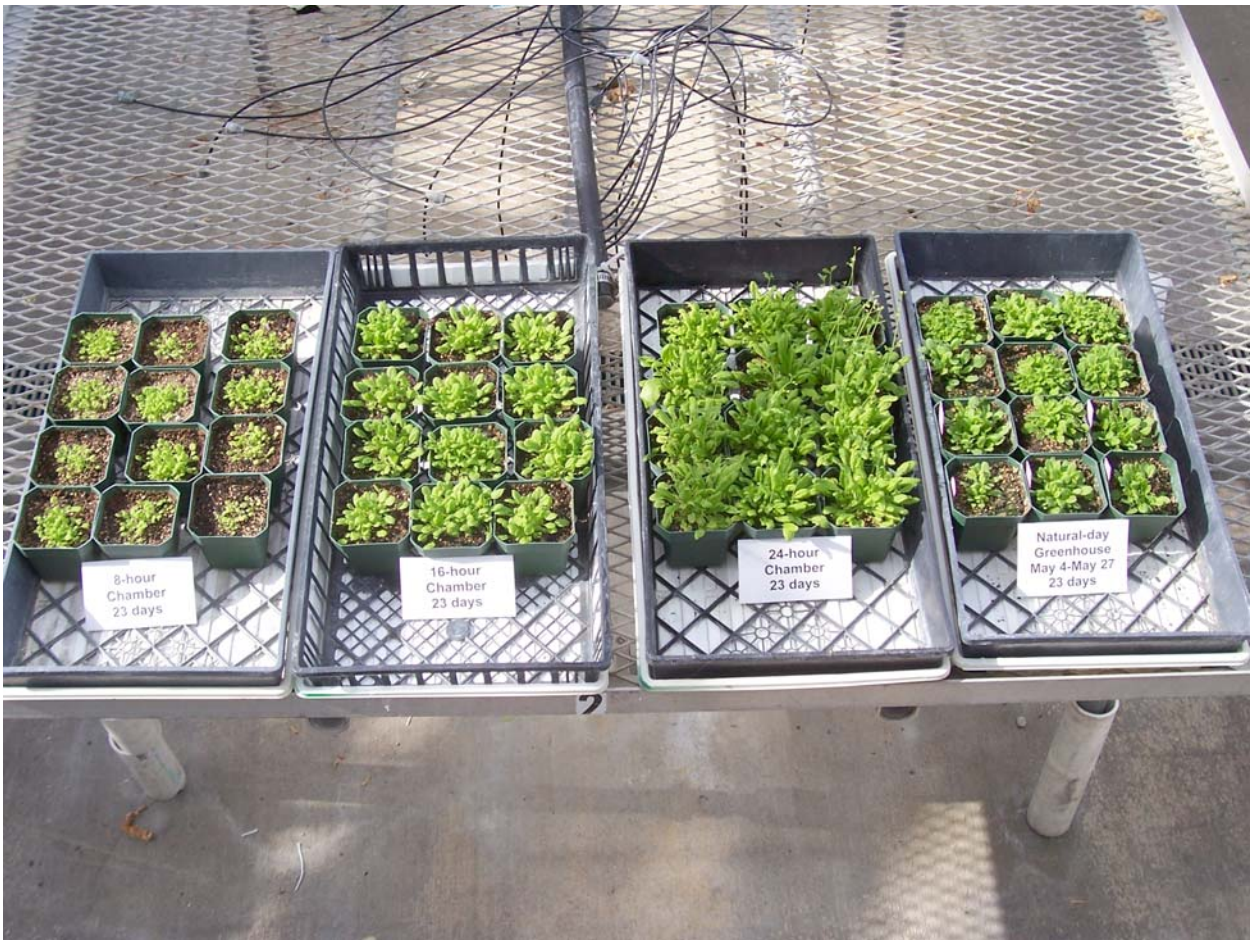

Figure 1. From left to right: Plants grown in growth chambers under 8, 16, and 24 hour photoperiod, respectively, and in a greenhouse under natural day photoperiod 4 March to 27 May.

Figure 2. From left to right: Plants grown in a greenhouse under natural short-days, 16-hour and 24-hour photoperiods, respectively. The photoperiods of the latter two treatments were extended using high intensity discharge lamps.

Figure 3. Plants grown in growth chambers under 16 hour photoperiod (left) and 24 hour photoperiod.

Figure 4. Plants grown under varying photoperiods and locations. The natural day condition of the pot on the left was a short day photoperiod.

Figure 5. Yellow leaves observed on plants grown under 24 hour photoperiod, possibly nutritional deficiency.